Burner Assembly and Cooktop Including Same

Field of the Invention

[01] The present invention is directed to a burner assembly and cooktop and cooking devices including the same. More particularly, certain examples are directed to a sealed burner assembly for use in cooktops, stoves, ranges and the like.

Background

[02] Cooktops typically have one or optionally include a series of burners disposed on a stove. The construction of the typical burner assembly allows for food to drop under and liquids to seep under the burner, which requires removal of the cooktop to clean the burner assembly. It may also be necessary to remove the cooktop to gain access to the gas system to undertake a pressure test, for example, in gas stoves. Reinstallation of the cooktop requires careful alignment of the cooktop and burners to ensure safely operating burners. There is a need in the art for a burner assembly and cooktop that overcomes these and other drawbacks of conventional burner assemblies.

[03] It is an object of the present invention to provide an improved burner assembly for use in gas and liquid fueled cooking devices. It is a particular object of certain preferred examples or embodiments to provide a sealed burner assembly for use in gas and liquid fueled cooking devices. These and other objects, embodiments, and examples are described below.

Summary

[04] In accordance with a first aspect, a burner assembly is provided. The burner assembly comprises a burner head comprising multiple burner ports and a fuel feed port in fluid communication with the multiple burner ports. The burner assembly also comprises a supply tube for supplying fuel to the burner head. At least in certain examples, the supply tube comprises a flange or shoulder at a first end of the supply tube. The burner assembly also comprises a force member operative to bias at least a portion of the supply tube, *e.g.*, a portion of the first end of the supply tube, into the fuel feed port of the burner head. At least certain examples of the burner assembly provide advantages including but not limited to a sealed burner head to prevent unwanted food or liquid from getting under the burner assembly. At least some examples of the burner assembly also provide a self-aligning burner assembly that allows an end-user to remove and reinstall the burner assembly if necessary. In certain examples discussed below, the burner assembly is configured for use in a portable cooking device, for use in a recreational vehicle and/or for use in residential and commercial applications.

[05] In accordance with a second aspect, a cooktop comprises a cooktop top and at least one burner head positioned in the cooktop top. The cooktop may optionally comprise a retaining member at the front of the cooktop top. In at least certain examples, the burner head comprises multiple burner ports and a fuel feed port in fluid communication with the multiple burner ports. The cooktop further comprises a burner box and at least one attaching member connecting the burner box and the cooktop top. In certain examples, the at least one attaching member

is configured to force the cooktop top downward relative to the burner box. In at least other certain examples, the burner box is configured to releasably receive the retaining member of the cooktop top to mate the cooktop top with the burner box. In some examples, the burner box comprises a burner box housing, at least one supply tube for feeding fuel to the burner head, and a force member acting against the burner box to bias at least a portion of the supply tube, *e.g.*, a portion of a first end of the supply tube, upwardly into the fuel feed port of the burner head. Certain examples or embodiments of the cooktop provide advantages including but not limited to a sealed burner head/sealed cooktop to prevent unwanted food or liquid from getting under the burner assembly and/or from getting under the cooktop top. Certain examples of the cooktop provide a cooktop top and burner box that is self-aligning which provides for accurate alignment of the supply tube and fuel feed port of the burner box. Additionally, in certain examples, a self-aligning cooktop allows an end-user to remove and reinstall the cooktop top if necessary. In certain examples discussed below, the cooktop is configured for use in a portable cooking device, for use in a recreational vehicle and/or for use in residential and commercial applications. In other examples, discussed below, the cooktop comprises one or more additional burners to provide multiple heat sources.

[06] In accordance with another aspect, a cooking device is provided. The cooking device comprises an oven cavity and a cooktop. The cooktop includes a cooktop top and at least one burner head positioned in the cooktop top. In at least some examples, the cooktop top comprises a retaining member at the front of the

cooktop top. In at least certain examples, the burner head comprises multiple burner ports and a fuel feed port in fluid communication with multiple burner ports. The cooktop of the cooking device further comprises a burner box and at least one attaching member connecting the burner box and the cooktop top. In certain examples discussed below, the at least one attaching member is configured to force the cooktop top downward relative to the burner box. In at least other certain examples, the burner box comprises a burner box housing, at least one supply tube for feeding fuel to the burner head, and a force member acting against the burner box to bias at least a portion of the supply tube, *e.g.*, a first end of the supply tube, upwardly into the fuel feed port of the burner head. Certain examples of the cooktop of the cooking device provide numerous advantages including but not limited to a sealed burner head/sealed cooktop to prevent unwanted food or liquid from getting under the burner assembly and/or from getting under the cooktop top. In other examples, the cooktop of the cooking device is self-aligning which allows an end-user to remove and reinstall the cooktop if necessary. In certain examples discussed below, the cooking device is configured for use as a portable cooking device, for use in a recreational vehicle and/or for use in residential and commercial applications. In other examples, discussed below, the cooking device comprises one or more additional burners to provide multiple heat sources.

[07] It will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure, that examples of the burner assemblies, cooktops and cooking devices disclosed here represent a significant technological advance. For

example, the self-aligning nature of at least certain examples of the burner assembly and cooktop provides a more efficient and reliable burner assembly, cooktop and/or cooking device. These and other advantages will be recognized by the person of ordinary skill in the art given the benefit of this disclosure.

Brief Description of Drawings

[08] Certain illustrative examples of the novel burner assembly, cooktop and cooking devices disclosed here are described below with reference to the accompanying drawings in which:

[09] FIG. 1 is a side-view, partly in section, of a burner assembly in a cooktop, in accordance with certain examples;

[10] FIG. 2A is a schematic of a supply tube, partly broken away, including a collar and gasket at one end, and FIG. 2B is an enlarged view of the collar of FIG. 2A, in accordance with certain examples;

[11] FIG. 3A is a perspective view of a force member, FIG. 3B is a side-view of the force member of FIG. 3A, and FIG. 3C is a top view of the force member shown in FIG. 3A, in accordance with certain examples;

[12] FIG. 4A is a side-view of another example f a force member and a perspective view of section A-A shown in FIG. 4A, in accordance with certain examples;

[13] FIG. 5 is a perspective view of a burner box including a plurality of supply tubes, in accordance with certain examples;

[14] FIG. 6 is another perspective view of the burner box of FIG. 5, in accordance with certain examples;

[15] FIG. 7 is a perspective view of a cooktop top comprising three burner heads, in accordance with certain examples;

[16] FIG. 8 is another perspective view of the cooktop top of FIG. 7, in accordance with certain examples;

[17] FIG. 9 is a perspective view of cooktop (shown open) comprising a cooktop top and a burner box, in accordance with certain examples;

[18] FIG. 10 is a perspective view of an assembled cooktop comprising a cooktop top, a burner box and a cooking grate, in accordance with certain examples; and

[19] FIG. 11 is a partly schematic, perspective view of a cooking device comprising an oven and a cooktop, in accordance with certain examples.

[20] It will be recognized by the person of ordinary skill in the art that the drawings are non-limiting and only exemplary and representative of the novel burner assembly and cooktops and cooking devices disclosed here.

Detailed Description of Certain Examples

[21] It will be recognized by the person of ordinary skill in the art that the examples or embodiments described below are only exemplary and representative of the novel burner assembly and cooktops and cooking devices including the same. Other

suitable configurations, modifications and alterations will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure.

[22] In accordance with a first example or embodiment, a burner assembly is shown in FIG. 1. Burner assembly 10 is shown installed in cooktop top 12 and burner box 13. Burner assembly 10 comprises a burner head 20, a supply tube 30 and a force member 40 in contact with supply tube 30. Burner head 20 is attached to top surface 12a of cooktop top 12 using suitable fastening member(s) 15, such as, for example, screws, rivets, bolts, and the like. In other examples, burner head 20 may be attached to cooktop top 12 using one or more high-temperature adhesives or may be spot welded, solvent welded or fitted with friction to cooktop top 12. Burner head 20 includes a fuel feed port 21 in fluid communication with multiple burner ports, such as burner port 22 shown in FIG. 1. Cooktop top 12 comprises an opening or aperture for receiving burner head 20. The aperture is configured suitably, *e.g.*, has suitable dimensions and/or shape, such that at least a portion of supply tube 30 may be biased into fuel feed port 21 of burner head 20 as discussed in more detail below. Suitable burner heads will be readily selected and designed by the person of ordinary skill in the art, given the benefit of this disclosure. The nature and size of the burner head depends on the intended use of the burner head. For example, in applications where the burner assembly disclosed here is to be used in domestic and/or commercial applications, the burner head outputs heat values of about 5200 BTU's/h to about 35,000 BTU's/h, more preferably about 6500 BTU's/h to about 32,000 BTU's/h, and most preferably about 7500 BTU's/h to about 15,000 BTU's/h, and the burner head has

a substantially circular shape with a diameter of about 2.25 inches to about 4 inches. In applications where the burner assembly disclosed here is to be used in a recreational vehicle, the burner head outputs heat values of about 5200 BTU's/h to about 12,000 BTU's/h, and more preferably about 6500 to about 9000 BTU's/h, and has a substantially circular shape with a diameter of about 2.25 inches to about 3.25 inches. In applications where the burner assembly is used in a portable cooking device, such as a portable stove, for example, the burner head has a substantially circular shape with a diameter of about 2 inches to about 4 inches and outputs heat values of about 5000 BTU's/h to about 10,000BTU's/h. However, other suitable dimensions, shapes, etc. will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure. Suitable burner heads are commercially available from numerous manufacturers including, but not limited to, Harper-Wyman, Mueller Gas Products, Sabaf, and Sourdillon.

[23] In certain examples, the burner head may further include, for example, igniter 50 in the example shown in FIG. 1, such as a spark igniter or spark electrode, for example, to provide a spark or flame to ignite or combust the fuel supplied to the burner ports of the burner head. Other suitable devices for igniting the supplied fuel, *e.g.*, for igniting a fuel-air mixture, include but are not limited to match lit ignition or flame ignition by an operator, manually operated igniters, such as those employing flint or the like, etc. Suitable devices for igniting the fuel are commercially available from Harper-Wyman, Mueller Gas Products, Sabaf, Sourdillon, etc. These and other suitable devices for igniting the fuel will be

readily employed by the person of ordinary skill in the art given the benefit of this disclosure.

[24] In accordance with certain examples, supply tube 30 of burner assembly 10 is selected from supply tubes such as Venturi tubes and the like. Suitable supply tubes are commercially available from Harper-Wyman, Mueller Gas Products, etc. The exact shapes, lengths and cross-sectional dimensions of the supply tube may vary depending on the particular design details and the intended use of the burner assembly. For example, in a typical burner assembly for use in recreational vehicles, the supply tube has dimensions of about 0.625 inches OD x 10.5 in length x 2.6 inches high as measured from the bottom of the burner box to the top of the highest portion of the supply tube when the supply tube is present in the assembled burner assembly. As discussed in more detail below, one end of the supply tube is in fluid communication with a manifold assembly comprising a gas valve or regulator that controls the amount of fuel that is introduced to the fuel feed port of the burner head. In certain examples, the supply tube has a radially extending flange or shoulder, *e.g.*, an annular flange, that is integral or unitary with the supply tube and configured to seat against or otherwise mate at least a portion of a burner head, *e.g.*, is configured so that at least a portion of the burner head rests on and/or is supported by the flange. The flange may be an expanded portion of the supply tube, *e.g.*, a bulge having a larger diameter, such that the flange is unitary or integral with the supply tube, whereas in other examples, the flange is non-integral and instead a collar having a flange can be press-fitted or frictionally fitted to the supply tube and can be removable from the

supply tube or optionally can be spot-welded, or attached using other methods, in one or more places to provide more permanent fixing of the collar to the supply tube. In certain examples, collar 45 (see FIGS. 2A and 2B) comprises annular flange 60 that extends radially from the collar and/or from a first end of the supply tube itself in the case of an integral or unitary flange. In at least certain examples, annular flange 60 is configured to support the bottom surface of the burner head. The collar may optionally include one or more conformable or non-conformable gaskets, such as gasket 55, to provide additional means for providing a seal between the fuel feed port of the burner head and the supply tube and/or to provide additional support for the burner head. Such gaskets can be made of metal, high-temperature plastics, high-temperature ceramics, or a suitable elastomeric or polymeric material or any other material that can withstand high temperatures, such as temperatures around about 260 °C to about 425 °C, or higher temperatures, for example. Suitable gaskets will be selected and designed by the person of ordinary skill in the art given the benefit of this disclosure, and exemplary gaskets include but are not limited to those gasket materials discussed above and gaskets made from, or including, silicone, Kevlar, copper and brass, for example.

[25] In certain examples, the supply tube may include a projection, boss, connector, etc. that is configured to mate with a portion of the force member. For example, the supply tube may include a radially extending projection that engages a slot on the force member to maintain contact between the force member and the supply tube. Such projection can be located on the supply tube in a suitable position for

engagement with a force member having a slot. For example, in at least certain examples, the projection or boss can be positioned below the integral or non-integral flange of the supply tube. However, it will be within the ability of the person of ordinary skill in the art, given the benefit of this disclosure, to position suitable projections or connectors on the supply tube for mating or engaging the supply tube and the force member. In certain examples, the projection or connector is positioned about 0.25 to about 1 inch below the flange, more preferably about 0.3 to about 1 inch below the flange and most preferably about 0.3 to about 0.5 inches below the flange.

[26] It will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure, that more or fewer supply tubes may be used depending on the intended application of the cooktop or cooking device. For example, in a typical portable stove, 1 or 2 supply tubes are used with 1 or 2 burner heads, respectively, to provide 1 or 2, operable burners. In a typical cooktop found in a recreational vehicle, 2, 3, or 4 supply tubes are used with 2, 3, or 4 burner heads, respectively, to provide, 2, 3, or 4 operable burners. In a typical cooktop for domestic or commercial use, 3 or 4 supply tubes are used with 3 or 4 burner heads, respectively, to provide 3 or 4 operable burners. It will also be recognized by the person of ordinary skill in the art, given the benefit of this disclosure, that if a burner box includes a plurality of supply tubes, the supply tubes may have different shapes, lengths, widths, dimensions, sizes, etc. For example, in certain examples, a first supply tube has a larger cross-sectional diameter to supply increased amounts of fuel to a fuel feed port of a corresponding burner head. In

some examples, a supply tube can be split, *e.g.*, bifurcated such that a single gas valve regulates supply of fuel to more than one burner head. These and other configurations will be readily selected and designed by the person of ordinary skill in the art, given the benefit of this disclosure.

[27] Referring again to FIG. 1, in certain examples force member 40 has an arcuate or serpentine configuration with one end configured to engage or rest against burner box 13 and a second end configured to engage or mate with supply tube 30. That is, in certain examples, the force member acts against the burner box to bias the supply tube upwardly into the fuel feed port of the burner head. In the example shown in FIG. 1, force member 40 is configured to allow movement of the supply tube in three dimensions, *e.g.*, to allow movement of the supply tube up and down, back and forth, and side-to-side. Force member 40 may not be permanently fixed to either supply tube 30 or burner box 13. Instead, the unique configuration of force member 40 provides for placement of force member 40 between supply tube 30 and burner box 13, which act to retain, or aid in retaining, force member 40 in place. In certain examples, however, it may be necessary to use one or more fastening devices, *e.g.*, screws, rivets, clips, bolts, lances etc., to fix force member 40 to the burner box, to the supply tube, or to both the burner box and the supply tube. In other examples, the bottom surface of the burner box may have one or more indentations, channels, depressions, etc. for receiving an end of the force member. It will be within the ability of the person of ordinary skill in the art, given the benefit of this disclosure, to select and design suitable fastening devices and fastening means for retaining the force member in the

burner box or for attachment of, or mating of, the force member to the burner box or supply tube or both.

[28] In some examples, as discussed above, force member 40 is configured to provide an upward force on supply tube 30 that biases a first end of the supply tube 30, *e.g.*, a first end of the supply tube having an integral or non-integral flange, into the fuel feed port of the burner head. In certain examples, force member 40 is configured to provide a seal or sealing fit between burner head 20 and supply tube 30, *e.g.*, a seal between the supply tube and the fuel feed port of the burner head. As used here a seal between the burner head and supply tube or a sealing fit between the burner head and supply tube refers to a seal or fit that provides a substantially flame-tight fit between the supply tube and the burner head such that the flame does not escape around the burner head-fuel feed port interface. This sealing fit may be accomplished at least in part by the flange, and, as discussed in more detail below, may also be assisted at least in part by the retaining member and/or attaching member that connects the burner box and the cooktop top and/or conformable gasket, which will be readily selected and/or designed by the person of ordinary skill in the art, given the benefit of this disclosure. Such sealing fit provides numerous advantages including, for example, a safer, more reliable and efficient burner assembly and is also a barrier to prevent food particles or liquid from entering, or dropping into, the burner head-fuel feed port interface. In certain examples, the force member is constructed from spring steel, *e.g.*, 26 gauge tempered spring steel (C1074-1075) having a C44-47 hardness. The force member may be made from other materials including but not limited to music

wire, stainless steel and the like. The widths and dimensions of the force member may vary but preferably the force member is of suitable width and dimensions to provide a sufficient biasing force to keep at least a portion of the supply tube, *e.g.*, a first end of the supply tube, biased with the fuel feed port of the burner head in the assembled burner assembly. For example, the force member, in its final configured state for use in a burner assembly, may be 0.5-3 inches wide, more preferably about 1-2 inches in wide and most preferably about 1-1.5 inches wide, *e.g.*, 1 inch wide. In an extended state, *e.g.*, the state prior to forming or shaping the force member to provide a suitable shape for use in a burner assembly, the force member may be about 6-10 inches long and about 0.5-3 inches wide, more preferably about 7-9 inches long and about 0.5-2 inches wide and most preferably about 8 inches long and about 1 inch wide. Other suitable widths and lengths will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure. The force member shown in FIG. 1 was made by press forming spring steel that was 1 inch wide and 8 inches long to final dimensions of about 2.34 inches high by about 2.46 inches in length by about 1.0 inch wide. Optionally, the force member may be coated or plated with one or more suitable materials to retard and/or prevent oxidation. Suitable materials include but are not limited to metals, zinc, zinc alloys, aerosols including zinc, polymers, titanium, aluminum, cadmium, and materials known to the person of ordinary skill in the art that resist, retard or reduce oxidation. Such suitable materials may be deposited or plated using numerous devices and methods including but not limited to spin coating, vapor deposition, electroplating, and the like.

[29] In accordance with another aspect, another example of a force member is shown in FIGS. 3A-3C. Force member 70 includes base portion or second end 72, arcuate or serpentine portion 74 and top portion or first end 76, which rests against, and/or is attached to, the supply tube in the assembled burner assembly. When the burner assembly is assembled in a cooktop, base portion 72 rests against the burner box. Force member 70 also includes slot 78 in a narrowing portion 77 of first end 76 of force member 70. Slot 78 of force member 70 is configured to receive a connector or projection of the supply tube to connect the force member and supply tube. The dimensions of force member 70 are generally shown using letters a, b and c in FIGS. 3B and 3C. In certain examples, dimension a shown in FIG. 3B is about 1-4 inches, more preferably about 2-3 inches and most preferably about 2.3-2.5 inches, *e.g.*, 2.34-2.36 inches. In certain examples, dimension b shown in FIG. 3B is about 1-4 inches, more preferably about 2-3 inches, and most preferably about 2.3-2.5 inches, *e.g.*, 2.45, 2.46 or 2.47 inches. In certain examples, dimension c shown in FIG. 3C is about 0.5-3 inches, more preferably about 0.75-2 inches and most preferably about 1 inch. Other suitable dimensions will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure.

[30] In accordance with an additional aspect, another example of a force member is shown in FIGS. 4A and 4B. In this example, the specific measurements of various sections of the force member are recited as if the force member was simply a flat device as shown in FIG. 4A. These measurements are only exemplary and the person of ordinary skill in the art, given the benefit of this

disclosure, will be able to design suitable force members having suitable dimensions. Referring to FIG. 4A, starting from the first end 80a, force member 80 has a first curved or angled portion 81 having a radius of about 0.3 +/- 0.02 inches. Connected to the first curved portion 81 of force member 80 is another curved, arcuate, or serpentine portion 82 with a radius of about 0.14 +/- 0.03 inches. Portion 82 is connected to another curved, arcuate or serpentine portion 83 having a radius of about 0.30 +/- 0.03 inches. Connected to portion 83 is a generally linear portion 84 that connects portion 83 with serpentine portion 85. The perpendicular distance between the portion of force member 80 that rest against the burner box and the central portion of curved force member 83 is represented by number 84a in FIG. 4A and is about 1.05 +/- 0.09 inches. An additional arcuate or serpentine portion 85 connects portion 84 and base portion 86. The radius of portion 85 of force member 80 is about 0.11 +/- 0.02 inches. The length of base portion 86 is represented by 87 in FIG. 4A and is about 0.88 +/- 0.03 inches. The distance between arcuate or serpentine portion 82 and the terminus of base portion 86 of force member 80 is represented by 88 in FIG. 4A and is about 1.98 +/- 0.09 inches. The distance between curved portion 81 and the terminus of base portion 86 is represented by 89 in FIG. 4A and is 2.171 +/- 0.100 inches. Distance 90 between the bottom portion of the slot of the force member and the terminus of base portion 86 is about 2.430 +/- 0.100 inches. Distance 91 between the terminus of first portion 80a of force member 80 and the terminus end of base portion 86 is about 2.462 +/- 0.100 inches. The perpendicular (or vertical) distance 92 between base portion 86 and curved portion 82 is about 0.63

+/- 0.09 inches. The perpendicular distance 93 between base portion 86 and curved portion 81 is about 2.15 +/- 0.03 inches. The perpendicular distance 94 between base portion 86 to the slot of force member 80 is about 2.15 +/- 0.03 inches. The perpendicular distance 90 from the base portion of 86 of force member 80 to the terminus of first portion 80a is about 2.340 +/-0.100 inches.

[31] In accordance with another aspect, FIG. 4B shows cross-section A-A of the first end 80a of the force member shown in FIG. 4A. As shown in FIG. 4B, force member 80 has a slot 98 having dimensions of about 0.6 +/- 0.1 inches in length and 0.08 +/- 0.01 inches in width. Distance 99a between slot 98 and radially extending portion 99 is about 0.35-0.37 inches. The radially extending portion 99 extends radially about 0.13 +/- 0.03 inches (shown as distance 101 in FIG. 4B) on each side of the portion of the first end that has slot 98. Terminus 102 of the force member is less wide than the other portions of the force member. The width 102a of terminus 102 is about 0.32 +/- 0.03 inches. Slot 98 shown in FIG. 4B is not uniform in shape but instead has a central arcuate portion 103 having a radius of about 0.06 +/- 0.02 inches. Other suitable dimensions for the force member will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure.

[32] In accordance with another aspect, a burner box comprising a burner assembly is shown in FIGS. 5 and 6. Burner box 105 comprises a burner box housing comprising a front surface 110, a bottom surface 120 and side surfaces 130 and 140. In this example of a burner box, burner box 105 comprises three supply tubes, 150, 160 and 170, a pressure regulator 180 and a manifold assembly 190.

The pressure regulator is in fluid communication with manifold assembly 190 and is operative to control the supply of fuel to manifold assembly 190. The pressure regulator may be any of the pressure regulators used in gas stoves, liquid fuel stoves and the like. Suitable pressure regulators are commercially available from Harper-Wyman, OARA, Marshall Gas, etc. The manifold assembly shown in FIGS. 5 and 6 is configured to control the amount of fuel supplied to each supply tube and includes one or more air intake ports so that the fuel supplied to the fuel feed port of the burner is a fuel-air mixture. The manifold assembly shown in FIGS. 5 and 6 comprises three gas valves 200, 210 and 220 that function independently of each other. That is, each of the gas valves independently controls the amount of fuel supplied to the supply tube in communication with that gas valve. In certain examples, the gas supplied to the supply tube may be any of the commonly used gases such as methane, ethane, propane, acetylene, hydrogen and the like. In other examples, the fuel may be butane, stoddard solvent, kerosene, alcohol, standard heating oil, diesel, paraffin, naptha, JP5, gasoline, *e.g.*, leaded gasoline, white gasoline, aviation gasoline and the like. It will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure, that depending on the type and nature of the fuel source, modifications to the burner assembly may be required. For example, in certain configurations the burner assembly may be used in combination with, or adapted for use with, a wick or other suitable devices for delivery of the fuel. In addition, the gas regulator and/or manifold assembly may be different depending on the nature and type of fuel used. Suitable manifold assemblies are commercially

available from numerous sources including, for example, Mueller Gas Products, Harper-Wyman, and BSI Incorporated. Other suitable manifold assembles will be readily selected and designed by the person of ordinary skill in the art, given the benefit of this disclosure.

[33] In accordance with certain examples, each of the supply tubes shown in FIGS. 5 and 6 is in communication with, *e.g.*, rests against, a force member that acts against the burner box to bias the supply tube upwardly into the fuel feed port of the burner head. For example, each of supply tubes 150, 160 and 170 is in contact with force members 230, 240 and 250, respectively. Force members 230, 240 and 250 are operative to bias at least a portion of supply tubes 150, 160 and 170 into the fuel feed port of a burner head. In at least certain examples, one or more, and preferably each, of supply tubes 150, 160 and 170 comprises a flange as described above, *e.g.*, a flange that is integral with the supply tube or is non-integral and provided by a collar that is fitted to the supply tube. Also as discussed above, the force members are each operative to bias at least a portion of the supply tube into the fuel feed port of the burner head, and preferably are designed such that the burner head rests against the flange of the supply tube. In certain examples, each of force members 230, 240, and 250 has the same dimensions, whereas in other examples, the force members have different dimensions depending on the size and dimensions of the supply tube, burner head, etc. In at least certain non-limiting examples, each of force members 230, 240 and 250 is constructed from spring steel, *e.g.*, 26 gauge tempered spring steel (C1074-1075) having a C44-47

hardness. Other suitable materials will be readily apparent to the person of ordinary skill in the art given the benefit of this disclosure.

[34] In accordance with an additional example, the burner box shown in FIGS. 5 and 6 includes at least one attaching member, and preferably two or more attaching members, attached at or to the rear of the burner box or a bottom surface of the burner box. For example, attaching members 260 and 270 are attached to bottom surface 120 and/or a rear portion 145 of burner box 105. The attaching members are operative to attach or to connect the cooktop top to the burner box. In at least certain examples, the attaching members are also configured to provide a downward force to the cooktop top so that the cooktop is forced downward towards the burner box. The downward force from the attaching member assists in engaging the fuel feed port of the burner head with the supply tube, which itself is being pushed upward by a force member. The attaching member may also provide a slight forward force which pushes the cooktop top slightly forward of a front surface of the burner box. In at least certain examples, such a forward force assists in positive alignment of the supply tubes with the fuel feed ports of the burner heads. It will be recognized by the person of ordinary skill in the art, given the benefit of this disclosure, that different numbers of attaching members may be used depending on the nature and intended use of the cooktop. For example, in portable cooking devices it is preferred to use one or two attaching members, and preferably one attaching member to reduce the weight and cost of the portable cooking device. In a typical cooktop used in recreational vehicles, *e.g.*, a cooktop including three supply tubes and three burner heads, it is preferred to use two

attaching members. In a typical cooktop used in domestic application, *e.g.*, a cooktop having four or more burners, it is preferred to use at least two, and more preferably at least three, attaching members. Suitable attaching members will be selected by the person of ordinary skill in the art including but not limited to brackets, spring-loaded brackets such as brackets including one or more spring members configured to pull an attached cooktop top downward towards the bottom surface of a burner box, and the like.

[35] In accordance with other examples, a cooktop top is shown in FIGS. 7 and 8. Referring to FIGS. 7 and 8, cooktop top 300 comprises first burner head 400 comprising fuel feed port 405, second burner head 410 comprising fuel feed port 415, and third burner head 420 comprising fuel feed port 425. Each of the burners is disposed in an opening or aperture in the cooktop top. Cooktop top 300 includes top surface 310 and bottom surface 320. As shown in FIG. 8, each of the burner heads is attached to the cooktop using two fastening members. For example, first burner head 400 is attached to cooktop top 300 using fastening members 500 and 505, second burner head 410 is attached to cooktop top 300 using fastening members 510 and 515, and third burner head 420 is attached to cooktop top 300 using fastening members 520 and 525. The fastening members may be screws, bolts, rivets, etc, or other suitable fastening members that will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure. Each of the first, second and third burner heads also has an associated igniter, 540, 550 and 560, which is operative to ignite the fuel supplied from the supply tube to the fuel feed port. Cooktop top 300 also include vents 595 on the

back of cooktop top 300 that allows for air to enter and/or exit under the cooktop top, which can reduce the temperature of the burner head-supply tube interface and prevent undesirable heating of the cooktop surface. The exact shape and design of the vents may vary depending on the intended use of the system, and suitable shapes and dimensions for the vents will be selected by the person of ordinary skill in the art given the benefit of this disclosure.

[36] Referring to FIG. 8, in certain other examples, attached to a front surface, and preferably a bottom, front surface, of cooktop top 300 is a retaining member 580 which is configured to fit into an opening or slot on the a surface, *e.g.*, a top surface, of the burner box. That is, a front surface of the cooktop top optionally comprises a retaining member that is operative to hold the cooktop top down when the retaining member is engaged with the hole or slot of the burner box. The retaining member also aids in keeping the supply tube engaged with the burner head. The retaining member may be a clip, projection, boss, weld, stud, etc., and preferably the retaining member is made of steel, such as tempered spring steel, or may be made of enameling iron, stainless steel, high temperature plastics, etc. Other suitable materials for constructing the retaining member will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure.

[37] In accordance with another example, a cooktop is shown in an open state in FIG. 9. Cooktop 600 comprises cooktop top 610 and burner box 620. Cooktop top 610 generally includes those elements discussed above in reference to FIGS. 7 and 8. Burner box 620 generally includes those elements discussed above in

reference to FIGS. 1-6. In certain examples, attaching members 630 and 640 attach to cooktop top 610 through holes or slots on a rear portion of cooktop top 610 and also attach to burner box 620 at a bottom surface of burner box 620. In some examples, fastening members, such as screws, rivets, etc. may be used to fasten the cooktop to the attaching members, while in other example, the cooktop may be spot welded to the attaching members. In certain examples, to assemble cooktop 600, cooktop top 610 is pulled downward and forward so that fastening member 650 of cooktop top 600 rests on a top surface of control panel 615 of burner box 620. The cooktop top is then set into place by pushing the cooktop top backwards until fastening member 650 engages a top surface, slot or hole of control panel 615. Once the fastening member engages a slot or hole at a top surface of the burner box, or under a top surface, the supply tubes are biased against the fuel feed ports of the burner heads and the cooktop is ready for use (see FIG. 10). The assembled cooktop 700 (see FIG. 10) also includes a cooking grate 710 that is disposed on the cooktop. Cooking grate 710 may be held to the top surface of the cooktop using numerous devices including clips, fasteners, studs and the like. Other suitable devices and methods for retaining cooking grate 710 will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure. In certain examples, the cooking grate is permanently disposed on the cooktop while in other examples the cooking grate is removeably disposed on the cooktop. The cooking grate may be made of numerous materials including but not limited to metals, metal alloys, combinations of metals, high

temperature ceramics and other materials which will be readily selected by the person of ordinary skilled in the art given the benefit of this disclosure.

[38] In accordance with an additional example, a cooking device is shown in FIG. 11. Cooking device 800 comprises an oven 810 and a cooktop 820. Cooktop 820 includes a cooktop top and a burner box, as described herein. The cooktop may further include an optional cooking grate 850, as discussed above, disposed on top of the cooktop. Oven 810 may be heated using the same fuel source supplied to the burner heads. However, in certain examples, the oven may be an electric oven while the burners may be fueled by any of the fuels discussed above and other fuels that will be readily selected by the person of ordinary skill in the art, given the benefit of this disclosure. Suitable ovens include but are not limited to those ovens commercially available from Atwood Mobile Products, Inc, Suburban Mfg., Magic Chef etc. The oven comprises an oven cavity that includes top, bottom, rear and side-wall portions. The oven also includes a door to facilitate placement and removal of food into and from the oven and to retain heat within the oven cavity. The oven typically includes one or more removable racks to elevate food from the bottom surface of the oven. The oven may have controls that are separate from the controls of cooktop, *e.g.*, the oven has separate controls for controlling the temperature of the oven so that the fuel supplied to the oven and the burner heads can be independently controlled. However, the controls for the oven may be the same as those for the cooktop depending on the configuration of the cooking device. It will be within the ability of the person of ordinary skill

in the art, given the benefit of this disclosure, to design suitable cooking devices including the burner assembly and cooktop disclosed here.

[39] Although certain examples or embodiments of the burner assembly, and cooktops and cooking devices including the same are described above, other examples, substitutions, modifications, alterations and the like will be selected by the person of ordinary skill in the art given the benefit of this disclosure. It is intended that the following claims encompass such other alterations, configurations, and the like.